SWISS PRECISION

DIMETIX
LASER DISTANCE SENSORS

Exchangeable cover – Industrial Ethernet

D-Series

Technical Reference Manual

V0.13

18.12.2020

Take precaution against electrostatic discharge (ESD)

- The exchangeable cover with Industrial Ethernet is a sensitive electronic part and can be damaged by electrostatic discharge.
- Only handle the device properly grounded and with care.
- No warranty will be granted on improper handling and / or ESD caused problems.

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Table of content

1 Document scope

This document covers the Dimetix exchangeable covers with Industrial Ethernet. The available types are listed in chapter 4.1 Specifications.

The following topics are discussed:

- Safety instructions
- Technical information

The Dimetix Exchangeable covers with Industrial Ethernet are intended to be used solely in conjunction with the D-Series laser sensor.

2 Safety instructions

- The exchangeable cover with Industrial Ethernet can only be used in conjunction with a D-Series laser sensor. For this reason all of the safety instructions mentioned in the Technical Reference Manual of the D-Series laser sensor must be observed too. The following safety instructions for the use of the exchangeable cover with Industrial Ethernet must be observed in addition.
- The following instructions are to enable the person responsible for the exchangeable cover with Industrial Ethernet, and the user of the instrument, to anticipate and avoid operational hazards.
- The person responsible for the instrument must ensure that all users understand these instructions and adhere to them.

2.1 Explanation of symbols

⚠ DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE	Indicates a potentially harmful situation which, if not avoided, may lead to property damage.
	High lights important information, product features and application hints.
	Means that the eye can be damaged by laser radiation, if precautions are not taken.

Means that the device can be damaged by electrostatic discharge, if precautions are not taken.

2.2 Permitted use

The permitted use of the exchangeable cover with Industrial Ethernet is: Expand D-Series laser sensor with Industrial Ethernet capabilities.

2.3 Prohibited use / Limits to use

Prohibited use or ignoring limits to use can lead to injury, malfunction, and material damage.

- It is the duty of the person responsible for the instrument to inform the user about hazards and how to counteract them.
- The exchangeable cover with Industrial Ethernet must not be operated until the user has been adequately instructed.

Prohibited use:

- Use of the instrument without instruction
- Use outside the stated limits
- Deactivation of safety systems and removal of explanatory and hazard labels
- Opening of the equipment, except to assemble to a D-Series device l
- Carrying out modification or conversion of the product
- Operation after failure in operation

⚠WARNING

NOTICE

- Use of accessories from other manufacturers without the express approval of Dimetix

Environmental limits to use. The device must not be used in environments such as but not limited to:

- Aggressive vapor or liquids (salt, acid, poison, etc.)
- Radiation (radioactive, heat, etc.)
- Explosive atmosphere

Limits to use by application. The device must not be used in applications such as but not limited to:

- Medical devices and equipment
- Safety-related automotive applications within vehicles
- Aerospace (Aviation & Space flight)
- Nuclear technology

Further limits to use.

- The device may not be used beyond the specifications in chapter 4 Technical data on page 9.

2.4 Areas of responsibility

Responsibilities of the manufacturer of the original equipment Dimetix AG, CH-9100 Herisau (Dimetix):

Dimetix is responsible for supplying the product, including the Technical Reference Manual and original accessories, in a completely safe condition.

Responsibilities of the manufacturer of non-Dimetix accessories:

The manufacturers of non-Dimetix accessories for the exchangeable cover with Industrial Ethernet are responsible for developing, implementing and communicating safety concepts for their products. They are also responsible for the effectiveness of these safety concepts in combination with the Dimetix equipment.

Responsibilities of the person in charge of the instrument:

The person in charge of the instrument has the following duties:

- To understand the safety instructions for the product and the instructions in the Technical Reference Manual.
- To be familiar with local safety regulations relating to accident prevention.
- To inform Dimetix immediately if the equipment becomes unsafe.

The person responsible for the instrument must ensure that the equipment is used in accordance with the instructions. This person is also accountable for the deployment of personnel and for their training and for the safety of the equipment when in use.

2.5 Hazards in use

⚠ WARNING

NOTICE

The absence of instruction, or the inadequate provision of instruction, can lead to incorrect or prohibited use, and can give rise to accidents with far-reaching personal, material and environmental consequences.

- All users must follow the safety instructions given by the manufacturer and the directions of the person responsible for the instrument.

⚠ WARNING

NOTICE

Beware of erroneous distance measurements if the instrument is defective or if it has been dropped or has been misused or modified.

⚠ WARNING

NOTICE

Operate the equipment appropriately in accordance with the regulations in force.

- Always prevent access to the equipment by unauthorized personnel.

2.6 Electromagnetic compatibility (EMC)

The term "electromagnetic compatibility" is taken to mean the capability of the exchangeable cover with Industrial Ethernet to function smoothly in an environment where electromagnetic radiation and electrostatic discharges are present, and without causing electromagnetic interference to other equipment.

2.7 Electrostatic discharge (ESD)

Take precaution against electrostatic discharge (ESD)

- The exchangeable cover with Industrial Ethernet is a sensitive electronic part and can be damaged by electrostatic discharge.
- Only handle the device properly grounded and with care.
- No warranty will be granted on improper handling and / or ESD caused problems.

2.8 Producer standards

Dimetix hereby certifies that the product has been tested and complies with the specifications as stated in this 'Technical Reference Manual'. The test equipment used is in compliance with national and international standards. This is established by our Quality Management System. Further, the exchangeable cover with Industrial Ethernet are produced in compliance with 2011/65/EU «RoHS».

2.9 Disposal

This symbol on the product or on its packaging indicates that this product must not be disposed of with your other household waste. Instead, it is your responsibility to dispose of the equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local city office, your household waste disposal service or the dealer where you purchased the product.

In countries in which Dimetix has no subsidiaries, Dimetix delegates the duty for the disposal in compliance with 2012/19/EU«WEEE» to the local dealer or to the customer, if no dealer is present.

2.10 Labeling

The labeling of the exchangeable cover with Industrial Ethernet is shown in figure 10. The labels includes the Industrial Ethernet protocol description, some specific protocol markings, the part number and the serial number.

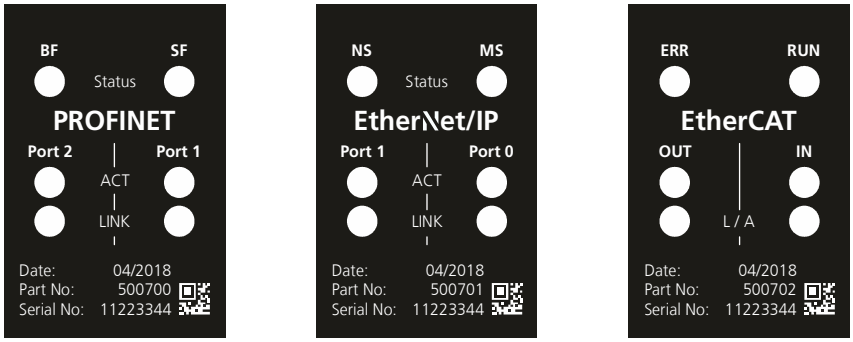


Figure 1: Labeling of the available exchangeable cover with Industrial Ethernet.

2.11 Maintenance

The exchangeable cover with Industrial Ethernet device is almost maintenance free. Only keep the connectors and the top of the exchangeable cover used for the status LED's clean.

2.12 Service

If you need to service the device, please contact Dimetix for instructions.

The warranty is void if the device is modified. Removing the label is also understood as modifying.

3 Introduction

The exchangeable cover with Industrial Ethernet is an optional and powerful extension of the D-Series laser sensors with the most popular Industrial Ethernet protocols – PROFINET®, EtherNet/IP™ and EtherCAT®. It's possible to assemble the exchangeable cover with Industrial Ethernet to almost all of the D-Series laser sensor.

PROFINET®

EtherNet/IP™

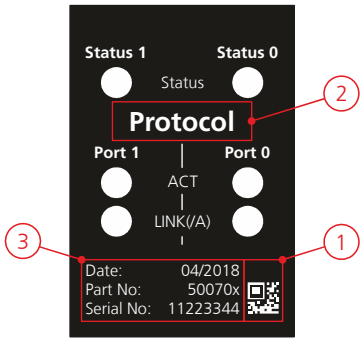
EtherCAT®[1]

Key features:

- Most popular Industrial Ethernet interfaces available – PROFINET®, EthernNet/IP™ and EtherCAT®
- Simple assembling of the optional Industrial Ethernet interfaces to a D-Series laser sensor
- Compact design of the exchangeable cover with Industrial Ethernet
- IP65 (Protected against ingress of dust and water) together with D-Series laser sensor
- Wide range of power supply (12...30 VDC)
- Wide range of operating temperature (depends on D-Series device)
- High cyclic measurement data exchange over Industrial Ethernet protocol (up to 500 Hz / ≥2 ms)
- Simple data structure of cyclic / acyclic data and integration in network
- Configuration possibilities of D-Series laser sensor with cyclic and acyclic protocol communication

3.1 Product identification

The Dimetix products are identified by the label on the top of the device. The identification on the label shows the main properties of each device. Every device has a unique identification. For more details see the figure below.



Identification of the exchangeable cover with Industrial Ethernet:

1) QR code with serial number of the corresponding exchangeable cover with Industrial Ethernet
2) Description / Name of the Industrial Ethernet protocol running on the corresponding exchangeable cover with Industrial Ethernet
   Available Industrial Ethernet protocols: PROFINET®, EtherNet/IP™, EtherCAT®
3) Manufacturer data, part number and serial number of the corresponding exchangeable cover with Industrial Ethernet

1 EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

3.2 Components

The components of the exchangeable cover with Industrial Ethernet interfaces are marked in figure 2.

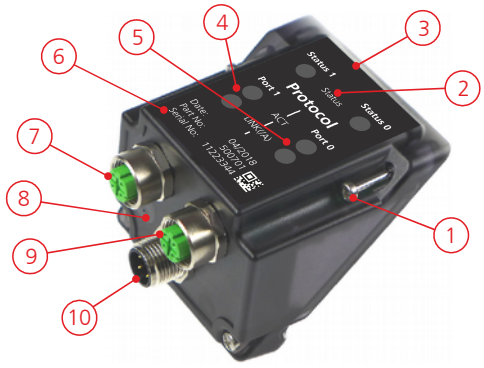


Figure 2: Components with detail information of the exchangeable cover with Industrial Ethernet

1) Screws, Philips Slotted Combo (Philips size 1, slot size 2)
2) Industrial Ethernet protocol status LED's
3) Ribbon cable to connect exchangeable cover to D-Series devices
4) Ethernet port 1 status LED's (Link, activity)
5) Ethernet port 0 status LED's (Link, activity)
6) Product label (for more details, see chapter 2.10)
7) Ethernet port 1
8) Valve diaphragm
9) Ethernet port 0
10) Power supply (for D-Series device and exchangeable cover)

Take precaution against electrostatic discharge (ESD)

- The exchangeable cover with Industrial Ethernet is a sensitive electronic part and can be damaged by electrostatic discharge.
- Only handle the device properly grounded and with care.
- No warranty will be granted on improper handling and / or ESD caused problems.

3.3 Validity

This manual is valid for exchangeable cover with Industrial Ethernet and the following firmware versions:

- Sensor interface board firmware version: **V1.19 or later**
- Industrial Ethernet stack firmware version (for PROFINET®): **V4.3.0.9 or later**
- Industrial Ethernet stack firmware version (for EtherNet/IP™): **V3.4.0.5 or later**
- Industrial Ethernet stack firmware version (for EtherCAT®): **V4.7.0.4 or later**

To get the firmware versions see the parameter list of the corresponding Industrial Ethernet protocol.

4 Technical data

4.1 Specifications

	PROFINET®	EtherNet/IP™	EtherCAT®
Part number	500700	500701	500702
Protocol specific Designator Specification	 PROFINET IO See chapter 7.1	 EtherNet/IP™ See chapter 8.1	 EtherCAT® See chapter 9.1
Industrial Ethernet Number of ports Data rate	 2 100 Mbit/s (Full duplex)		
Power supply (D-Series device incl. Industrial Ethernet) Voltage range Current consumption (@ 24 VDC) [1] Current consumption (@ 12 VDC) [1]	 12...30 VDC 0.25...0.6 A 0.8...1.0 A		
Temperature range during operation [2]	-40...+50°C		
Temperature range during storage	-40...+70°C		
Relative humidity (operation / storage)	85% (RH), non-condensing		
Degree of protection	IP65 (only if correct assembled with a D-Series sensor and connected ports)		
Dimensions [3]	68 x 58 x 47 mm		
Weight	90 g (with ribbon cable)		
Material	Polycarbonate (semi-transparent)		
Electromagnetic compatibility (EMC)	IEC/EN 61000-6-4 / 61000-6-3 IEC/EN 61000-6-2 / 61000-6-1		

[1] The current consumption is specified for an exchangeable cover with Industrial Ethernet connected to a D-Series sensor. Consider that the current consumption of the D-Series sensor depends on the supply voltage and the D-Series sensor type. For details about the D-Series sensor, see the corresponding *Technical Reference Manual*. Generally the exchangeable cover with Industrial Ethernet consumes about 1.6 W.

[2] The temperature range for an exchangeable cover with Industrial Ethernet depends on the temperature range of the D-Series sensor too. Consider the specified temperature range of the connected D-Series sensor. In case of permanent measurement (continuous distance measurement) the max. temperature during operation may be reduced.

[3] The physical dimensions are specified for the exchangeable cover only. For the physical dimensions with a connected D-Series sensor, see 4.2.2 for details.

4.2 Physical dimensions

The physical dimension for an exchangeable cover with Industrial Ethernet is part of this chapter. In addition, the physical dimension of an exchangeable cover connected to a D-Series sensor is available in this chapter too.

4.2.1 Exchangeable cover with Industrial Ethernet

For CAD data of the D-Series sensors please check our website or contact us (Website and contact information see www.dimetix.com).

4.2.2 D-Series device with Industrial Ethernet

For CAD data of the D-Series sensors please check our website or contact us (Website and contact information see www.dimetix.com).

5 Electrical interfaces

The main electrical components of the exchangeable cover with Industrial Ethernet are described in the following chapter. The overview of the relevant components are labeled in figure 3.

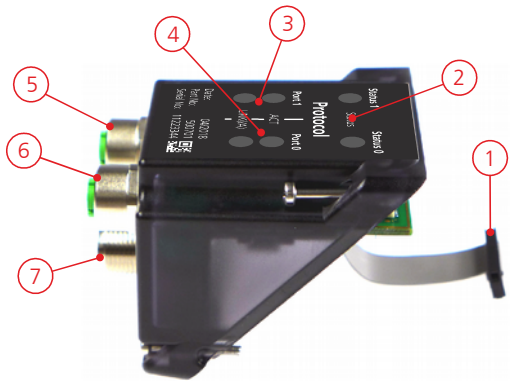


Figure 3: Overview electrical components of the exchangeable cover with Industrial Ethernet

1) Ribbon cable (20 pin) to connect exchangeable cover with Industrial Ethernet to D-Series devices
2) Industrial Ethernet protocol status LED's
3) Ethernet port 1 status LED's: LINK, ACT or L/A
4) Ethernet port 0 status LED's: LINK, ACT or L/A
5) Ethernet port 1 (M12 socket female, 4 pin, D coded)
6) Ethernet port 0 (M12 socket female, 4 pin, D coded)
7) Power supply (M12 socket male, 4 pin, A coded). Power supply used for D-Series device and exchangeable cover with Industrial Ethernet.

Take precaution against electrostatic discharge (ESD)

- The exchangeable cover with Industrial Ethernet is a sensitive electronic part and can be damaged by electrostatic discharge.
- Only handle the device properly grounded and with care.
- No warranty will be granted on improper handling and / or ESD caused problems.

5.1 Power supply

The connector for the power supply (M12 socket, A coded) is shown in figure 4. The power supply of the exchangeable cover with Industrial Ethernet is also used for the D-Series laser sensor. For this reason no additional power supply is needed for the D-Series device.

All of the exchangeable cover with Industrial Ethernet interfaces are overvoltage and reverse voltage protected. But for proper operation of the exchangeable covers consider the power supply requirements and the corresponding specifications.

The metal case of the M12 connector is not connected to any shield or housing. For details about the shielding concept of the exchangeable cover and the connected D-Series devices, see chapter 5.4.

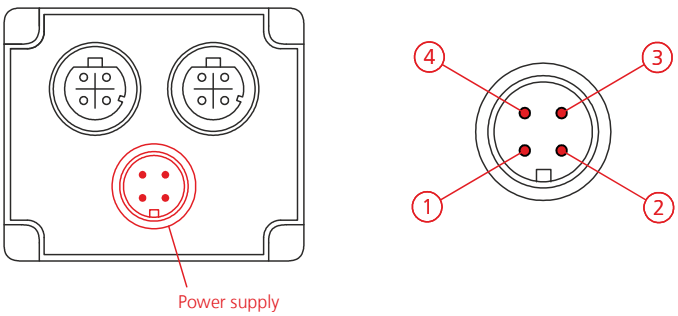


Figure 4: Connection diagram of the sensor power supply

Connection diagram of power supply connector (M12 socket male, 4 pin, A coded):

1) Supply voltage V+ (12...30 VDC)
2) Supply voltage GND (0 V)
3) Not connected (NC)
4) Not connected (NC)

Voltage and current requirements are detailed in chapter 4.1. Note that the current consumption depends on the D-Series sensor type.

⚠ CAUTION

NOTICE

Only use high-quality power supply equipment and consider the voltage and current requirements of the exchangeable cover with Industrial Ethernet.

- For trouble-free operation it's recommended to use a separate power supply for the sensors.

5.2 Ethernet ports

The connector for the Ethernet ports (M12 socket, D coded) are shown in figure 5. There are two Ethernet ports for the Industrial Ethernet functionality available. How the Ethernet ports work depends on the Industrial Ethernet protocol. For more details see the protocol specific part in this manual.

The metal cases of the M12 connectors are connected individually over an R-C element to the aluminum housing (shield) of the D-Series device. For details about the shielding concept of the exchangeable cover and the connected D-Series devices, see chapter 5.4.

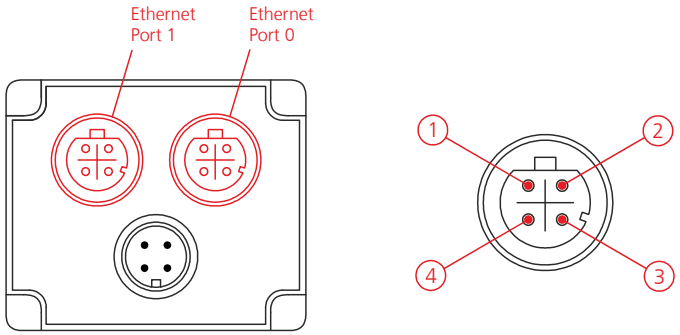


Figure 5: Connection diagram of the Ethernet port 0 & 1

Connection diagram of Ethernet port 0 and 1 (M12 socket female, 4 pin, D coded):

1) Transmit data positive (Tx+)
2) Receive data positive (Rx+)
3) Transmit data negative (Tx-)
4) Receive data negative (Rx-)

The Ethernet signals and connector are standard used in conjunction with Industrial Ethernet interfaces. For this reason no detailed specification is listed.

The table below lists the information about the Ethernet ports 0 & 1 (see figure 5) assignment used for the Industrial Ethernet protocol PROFINET®, EtherNet/IP™ and EtherCAT®.

Ethernet ports (see figure 5)	**PROFINET®**	**EtherNet/IP™**	**EtherCAT®**
Port 0	Port 1	Port 0	IN
Port 1	Port 2	Port 1	OUT

5.3 Ribbon cable

The ribbon cable of the exchangeable cover with Industrial Ethernet can be connected directly to a D-Series laser sensor. The connection diagram is illustrated in figure 6.This allows the extension of the available D-Series device interfaces with optional Industrial Ethernet interfaces. For more details about the available Industrial Ethernet protocols, see the specification in 4.1.

To use the exchangeable cover with one of the available Industrial Ethernet protocols all other sensor connectors and interfaces have to be disconnected otherwise the D-Series sensor or exchangeable cover may damage.

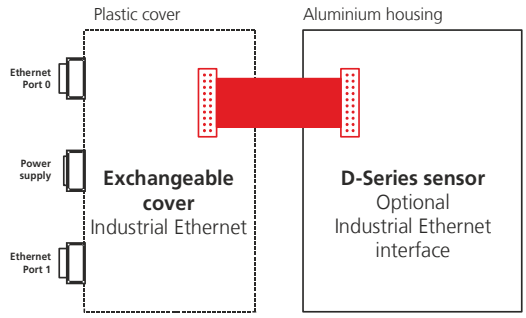


Figure 6: Connection diagram of exchangeable cover with Industrial Ethernet and D-Series sensor

The connection of the exchangeable cover with Industrial Ethernet to a D-Series sensor is done with the ribbon cable of the exchangeable cover.

Ribbon cable of exchangeable cover:

- 20 conductors with codded connectors
- Grid 0.635 mm
- Length 60 mm with connectors

The signals of the ribbon cable are not specified explicitly at this point. The optional Industrial Ethernet interface of the D-Series devices is a Dimetix specific interface.

Only use the original Dimetix flat ribbon cable to connect the D-Series Sensor with the exchangeable cover for Industrial Ethernet.

5.4 Shielding

The shielding concept of the exchangeable cover with Industrial Ethernet connected to a D-Series laser sensor is shown in figure 7 and described below.

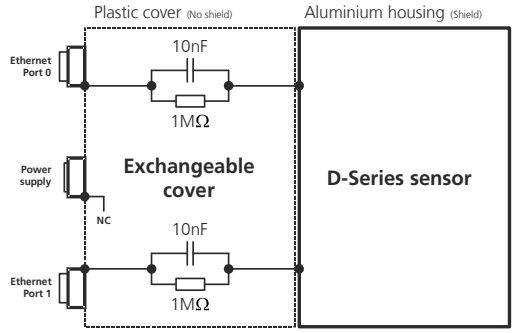


Figure 7: Shielding concept of the D-Series sensor and the exchangeable cover with Industrial Ethernet

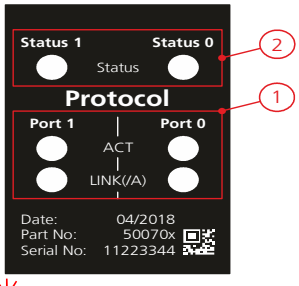
The exchangeable cover with Industrial Ethernet is made of plastic and so insulated (electrically). For that reason it's important to consider the shielding concept and the following information:

- The metal case of the power supply connector (M12 socket male, A coded) is not connected (NC) to the aluminum housing (shield) of the D-Series device.
- The metal cases of the Ethernet port 0 & 1 connectors (M12 sockets female, D coded) are connected individually over an R-C element to the aluminum housing (shield) of the D-Series device. Consider that this can only be guaranteed if the exchangeable cover is properly connected and assembled with the D-Series laser sensor.

5.5 Status LED

The LED's on the exchangeable cover with Industrial Ethernet show the status of the corresponding Industrial Ethernet protocol (PROFINET®, EtherNet/IP™ or EtherCAT®) and the LINK, ACT and L/A on the Ethernet ports.

The meaning of the LINK and ACT LED's of the Ethernet port 0 & 1 is almost the same for all Industrial Ethernet protocols (see the description below). But the meaning of the status LED's for the Industrial Ethernet protocol is different and depends on the corresponding protocol. For details about the status and the Ethernet port conditions, see the chapter of the corresponding Industrial Ethernet protocol.



Identification of the existing status LED's of the exchangeable cover with Industrial Ethernet:

1) Link and activity LED for Ethernet port 0 & 1
   LINK (green) and ACT (yellow) LED → PROFINET®, EtherNet/IP™
   L/A (green) LED → EtherCAT®
2) Status LED's (Status LED 0 & 1) of the Industrial Ethernet communication protocol. The description of the status LED's depends on the protocol. For details about the status conditions, see the chapter of the corresponding Industrial Ethernet protocol.
   Available Industrial Ethernet protocols: PROFINET®, EtherNet/IP™, EtherCAT®

LINK (L/): On when a link has been established on the corresponding Ethernet port.
ACT: (/A) Flashing when data is received or transmitted on the corresponding Ethernet port.

6 Operation

6.1 Installation

The available optional Industrial Ethernet interfaces are designed as exchangeable cover. The most of the available D-Series devices can be easy extended with such an optional Industrial Ethernet interface.

The installation procedure of the exchangeable cover is described in steps. To ensure a correct and proper assembling the steps has to be followed accurately. See the installation procedure below:

NOTICE

Take precaution against electrostatic discharge (ESD)

- The exchangeable cover with Industrial Ethernet is a sensitive electronic part and can be damaged by electrostatic discharge.
- Only handle the device properly grounded and with care.
- No warranty will be granted on improper handling and / or ESD caused problems.

NOTICE

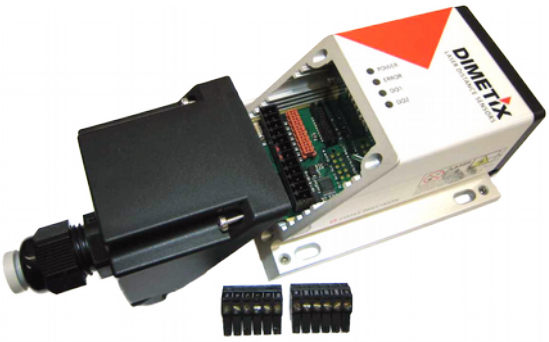
Connecting the exchangeable cover for Industrial Ethernet to the sensor under voltage may damage one of these components.

- Switch of the power supply before connecting the exchangeable cover for Industrial Ethernet to the sensor
- No warranty will be granted on improper handling.

NOTICE

Connecting the exchangeable cover for Industrial Ethernet simultaneously with one of the other interfaces of the sensor may damage one of these components.

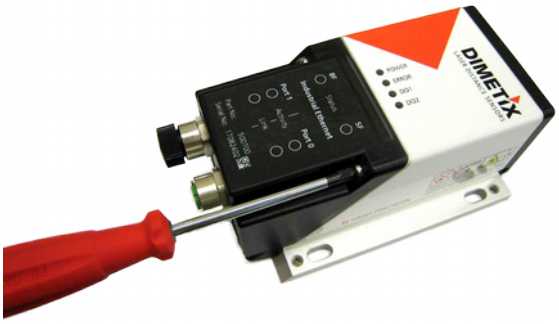
- Disconnect all other interface cables before connecting the exchangeable cover for Industrial Ethernet to the sensor.



1) Remove the standard cover with cable gland of the D-Series laser sensor.
Unbolt the four screws in the standard cover (Philips Slotted Combo, Philips size 1, slot size 2)

2) Disconnect / Remove the screw terminal plug from the terminal block.
Never use the screw terminal block and the exchangeable cover with Industrial Ethernet together.

3) Connect the ribbon cable (20 conductors) of the exchangeable cover with Industrial Ethernet to the D-Series device. The connection of the ribbon cable is shown on the left.
Never connect the ribbon cable if any Ethernet port or power supply is connected to the exchangeable cover with Industrial Ethernet.
For more details about the ribbon cable see chapter 5.3.



4) Assemble the exchangeable cover and the D-Series laser sensor carefully.
   - Before tighten the exchangeable cover: Check that the cover is properly aligned with the housing of the D-Series device. Make sure the four centering bolts are in position before tighten the screws.
   - Tighten the four screws over cross to have an equably pressure on the gasket. The target torque for these screws (Philips Slotted Combo, Philips size 1, slot size 2) is 1.6 Ncm.
5) Connect the Ethernet connectors to the Ethernet ports 0 / 1 and the power supply connector to the exchangeable cover with Industrial Ethernet. For details about the connectors, see chapter 5.1 5.2.
6) The D-Series laser sensor with exchangeable cover with Industrial Ethernet is ready for use.

6.2 General functionality

6.2.1 Cyclic / Acyclic data communication

The D-Series device with Industrial Ethernet interface use cyclic (Process data) and acyclic communication for configuration, operation and identification. The cyclic and acyclic communication functionality is described below and illustrated in figure 9.

- **Cyclic communication (Process data)**
  Used for measurement data and to control the D-Series laser sensor. The cyclic process data consists of output and input data with fixed mapping and size. For the output data (Device input data) a data range check is done automatically. The sensor state parameter *Sensor Output Data Limit Exceeded* shows the state of this range check.
  For more details about the available cyclic process data (I/O data), see the marked rows in the table of chapter 6.3 Parameter description (Cyclic process data marked in the column *Access – Cyclic*).
- **Acyclic communication**
  Used to read sensor information (Serial number, part number, firmware versions, etc.) and to write some sensor configurations (Measurement speed, measurement characteristic and distance unit) acyclic to the cyclic communication. The acyclic data (/parameter) can be read and / or write independently according the defined acyclic access type.
  For more details about the available acyclic data access, see the marked rows in the table of chapter 6.3 Parameter description (Acyclic data access marked in the column *Access – Acyclic*).

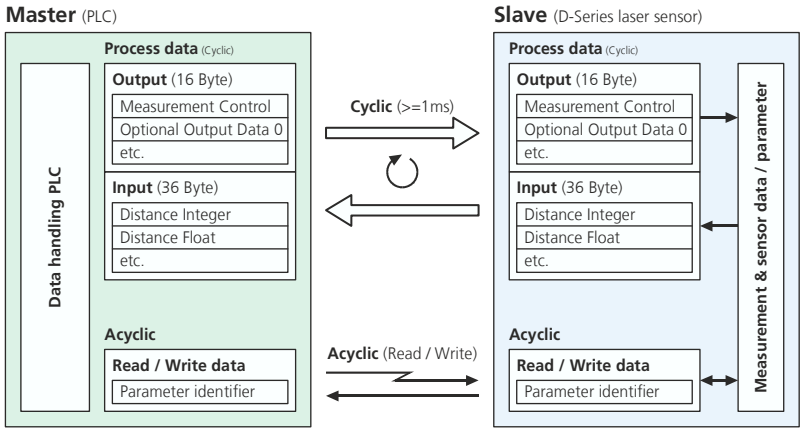


Figure 9: Cyclic (Process data) and acyclic communication between Industrial Ethernet Master (PLC) and the D-Series device with Industrial Ethernet interface.

The cyclic and acyclic data access details (e.g. number, index, class, ...) are specified in separate tables for the available Industrial Ethernet interface protocols (PROFINET®, EtherNet/IP™, EtherCAT®). For details see the corresponding chapter.

For more details about the configuration and control possibilities and an example of a standard configuration and control sequence for a D-Series laser sensor, see the following chapter 6.2.2 Control and configuration for details.

6.2.2 Control and configuration

The D-Series laser sensor with Industrial Ethernet (exchangeable cover) can be controlled and configured in its entirety over the Industrial Ethernet interface with cyclic (Process data) and acyclic data communication. The control and configuration parameter are described in chapter 6.3 Parameter description, see the parameter group "Measurement configuration".

A standard configuration and control sequence for a D-Series laser sensor with Industrial Ethernet is listed below. Precondition is the successful installation of the exchangeable cover with Industrial Ethernet, the connection of the power supply and the used Ethernet ports described in chapter 6.1.

Step	Description	Access [1]	Actions [2]	Remark
1	Connection	-	Precondition is the correct installation / setup of the D-Series device, see chapter 6.1.	
2		-	Turn on the power supply and check the green power LED on the D-Series device.	Voltage range and current consumption in the specification (see chapter 4.1) have to be considered.
3	Control	Cyclic	Set *Measurement Control* to 0 to stop distance measurement of D-Series laser sensor.	For more details about the measurement control, see chapter 6.3 Parameter description.
4	Configuration	Acyclic	Set the *Measurement Characteristic* E.g. "Normal"	For the most application, the "Normal" measurement characteristic is fine. For more details about the available measurement characteristics, see chapter 6.3 Parameter description.
5		Acyclic	Set the *Measurement Speed* E.g. "0" for measurements as fast as possible	The measurement speed allows the configuration of an automatic distance measurement trigger in a defined speed range. For more details about the measurement speed, see chapter 6.3 Parameter description.
6		Acyclic	Set the *Distance Unit* E.g. "mm"	For more details about the available distance units, see chapter 6.3 Parameter description.
7	Control	Cyclic	Set *Measurement Control* for start / stop of distance measurement of D-Series laser sensor.	For more details about the measurement control, see chapter 6.3 Parameter description.
...	Operation	Cyclic	Use cyclic process data with input and output data for measurement data (Distance, temperature, ...) and control	Cyclic process data will be updated with measurement data (only if *Measurement Control* was set to 1 / started before).
		Acyclic	Use acyclic read / write of data / parameter for additional information and configuration	Acyclic communication can be performed with low priority beside the cyclic process data communication. **Attention:** Some configurations take effect not before the measurement was stopped and restarted. For more details, see the corresponding configuration data in chapter 6.3 Parameter description.

[1] The communication has to be cyclic or acyclic. Cyclic data (Process data) communication consists of output and input data (I/O data). Acyclic data communication allows read and / or write access. For details about the available cyclic / acyclic data access, see the markings in the table of chapter 6.3 Parameter description.

[2] The used designation of cyclic and acyclic data (in italic) corresponds to the data / parameter table in chapter 6.3 Parameter description.

The sensor only considers changes in measurement speed and characteristics at measurement start. Setting Measurement Control to 0 stops the running measurement. When restarting the measurements the new configurations will be enabled.

6.3 Parameter description

The following table shows all available parameter (cyclic and acyclic data) of the exchangeable cover with Industrial Ethernet connected to a D-Series laser sensor. For every single parameter with the specific designation the functionality, the data type with size, the lower / upper limits and the default value are described. The parameter are organized in parameter groups to simplify and make it clearly arranged.

Consider that the designations of every single parameter are exactly used in the descriptions of the cyclic process data and the acyclic data of the corresponding Industrial Ethernet protocol.

Group	Number	Designation	Description	Data type [1]	Default value	Limit		Access [2]	
						Lower	Upper	Cyclic	Acyclic
Measurement configuration	8193	Measurement Control	Measurement control to start and stop continuous distance measurement. 0 –› Stop / No measurement, 1 –› Start measurement (with configured speed and measurement characteristic) Remark: Configured measurement speed and measurement characteristic are only considered at measurement start. For an other measurement configuration the measurement must be stopped first and than restarted again.	UINT16	0	0	1	O	R
	8194	Measurement Speed	Measurement time for a single distance measurement (Measurement speed of continuous measurement is calculated with 1 / Time). 0 –› Measurement as fast as possible, >0 –› Time in [ms] This configuration takes effect not before a new measurement is started. Remark: Measurement speed depends on measurement conditions and may vary.	UINT32	0	0	86400000	-	R / W
	8195	Measurement Characteristic	Measurement characteristic configuration used for distance measurement. 0 –› Normal, 1 –› Fast, 2 –› Precise, 3 –› Timed, 4 –› Moving target Measurement characteristics enable the user to customize measurement behaviors in a specific measurement application. This configuration takes effect not before a new measurement is started. For more details about the available measurement characteristics, see the Technical Reference Manual of the D-Series laser sensor.	UINT8	0	0	4	-	R / W
	8196	Distance Unit	Distance unit for distance output (configurable / selectable). 0 –› um, 1 –› mm, 2 –› cm, 3 –› m, 4 –› mil, 5 –› inch, 6 –› ft The distance unit configuration takes immediately effect on the distance parameters (Integer and float) of the D-Series sensor.	UINT8	0	0	6	I	R / W
	8197	Additional Measurement Filter 1	Additional plausibility check of the distance measurement by the max. allowed distance change / jump configuration. 0 –› Filter disabled, >0 –› Max. allowed distance change in [0.1 mm] Distance change check between the last and newest distance measurement is done according above configuration.	UINT32	0	0	5000000	-	R / W
	8198	Additional Measurement	Additional calming filter for distance measurements in Moving Target (see parameter	UINT32	0	0	400	-	R / W

		Filter 2	Measurement Characteristic) configuration. This filter smooths distance readings needed in some applications. 0 –› Filter disabled, 1...400 –› Calming filter length High filter lengths results in more distance calming / smoothing. Note that the response time of the sensor decreases accordingly when using long filter lengths. It's recommended to start with low filter lengths.						
Options Output	8225	Optional Output Data 0	Optional output data. Currently not used.	UINT16	0	0	0x7FFF	O	R
	8226	Optional Output Data 1	Optional output data. Currently not used.	UINT32	0	0	0x7FFFFFFF	O	R
	8227	Optional Output Data 2	Optional output data. Currently not used.	UINT32	0	0	0x7FFFFFFF	O	R
	8228	Optional Output Data 3	Optional output data. Currently not used.	UINT32	0	0	0x7FFFFFFF	O	R
Measurement	12289	Distance Integer	Measured distance as integer value in the configured / selected distance unit. Note that distance value will be truncated in case of unit conversion.	UINT32	0	0	0x7FFFFFFF	I	R
	12290	Distance Float	Measured distance as floating point value in the configured / selected distance unit.	FLOAT32	0.0	0.0	MAXFLOAT	I	R
	12291	Signal Strength	Signal strength of the active distance measurement. [1]	UINT32	0	0	0x7FFFFFFF	I	R
	12292	Temperature	Sensor temperature at the active distance measurement. [1/10 °C]	SINT16	0	-32768	32767	I	R
	12293	Measurement Actuality	Measurement actuality to show the state of the active distance measurement. 0 –› No new measurement, 1 –› New measurement, 2 –› Overwritten measurement	UINT8	0	0	2	I	R
	12294	Measurement Reserved	Reserved measurement data output. Currently not used.	UINT16	0	0	0x7FFF	I	R
Sensor State	12321	Sensor State	Sensor state for operation monitoring. 0 –› OK, 1 –› Info, 2 –› Warning, 3 –› Error	UINT8	0	0	0x7F	I	R
	12322	Sensor Output Data Limit Exceeded	Bit coded output data limit exceeded (lower or upper limit) warning. Limit exceeded indicator only used for process output data. Bit0 –› Measurement Control Bit1 –› Optional Output Data 0 Bit2 –› Optional Output Data 1 Bit3 –› Optional Output Data 2 Bit4 –› Optional Output Data 3 Bit5..7 –› Not used	UINT8	0	0	0xFF	I	R
	12323	Sensor Error Code	Sensor error code for troubleshooting (for error codes details see the Technical Reference Manual of the D-Series sensors).	UINT16	0	0	0x7FFF	I	R
Options Input	12353	Optional Input Data 0	Optional input data. Currently not used.	UINT16	0	0	0x7FFF	I	R
	12354	Optional Input Data 1 / Speed Integer	Speed data as integer value (with speed offset for data transmission) [mm/s] Real sensor / target speed = Speed Integer – 1'000'000	UINT32	0	0	0x7FFFFFFF	I	R

	12355	Optional Input Data 2	Optional input data. Currently not used.	UINT32	0	0	0x7FFFFFFF	I	R
	12356	Optional Input Data 3	Optional input data. Currently not used.	UINT32	0	0	0x7FFFFFFF	I	R
Hardware Information	16385	Serial Number	Serial number of device D-Series (without exchangeable cover).	UINT32				-	R
	16386	Part Number	Part number of device D-Series (without exchangeable cover).	UINT32				-	R
	16387	Part Description	Part description of device D-Series (without exchangeable cover).	STRING[20]				-	R
	16388	HW Version IF Board	Hardware version of device interface board D-Series (without exchangeable cover).	UINT16				-	R
	16389	HW Version M Module	Hardware version of device measurement module D-Series (without exchangeable cover).	UINT16				-	R
	16390	Serial Number RTE	Serial number of exchangeable cover with Industrial Ethernet.	UINT32				-	R
	16391	Part Number RTE	Part number of exchangeable cover with Industrial Ethernet.	UINT32				-	R
	16392	Part Description RTE	Part description of exchangeable cover with Industrial Ethernet.	STRING[20]				-	R
	16393	HW Version RTE	Hardware version of exchangeable cover with Industrial Ethernet.	UINT16				-	R
Firmware Information	16417	FW Version IF Board	Firmware version of device interface board D-Series (without exchangeable cover).	UINT16				-	R
	16418	FW Version M Module	Firmware version of device measurement module D-Series (without exchangeable cover).	UINT16				-	R
	16419	FW Version RTE SSBL	Not used. (Firmware version SSBL of the exchangeable cover with Industrial Ethernet)	UINT32				-	R
	16420	FW Version RTE Stack	Firmware version stack of the exchangeable cover with Industrial Ethernet.	UINT32				-	R

[1] Data types: UINTx / SINTx used for unsigned / signed integer values, x for size / number of bits (e.g. UINT16 –› 16 Bit / 2 Byte). FLOATx used for floating point values, x for size / number of bits (e.g. FLOAT32 –› 32 Bit / 4 Byte). STRING[x] used for character string, x for size / number of bytes (e.g. STRING[20] –› 20 Byte).

[2] Cyclic and acyclic data / parameter access: Column with cyclic access (process data), O –› Output data, I –› Input data. Column with acyclic access, R –› Read-only, R/W –› Read & Write.

6.4 Startup / Shutdown procedure

For startup or shutdown procedure the following points have to be considered:

- Power supply – Voltage range and current consumption (see the specifications in chapter 4.1).
- Do not switch on the power supply before the sensor finished the power down cycle properly.
- Do not switch off the power supply before the sensor finished the power up and configuration process properly.
- Stop measurement before switching off the sensors power supply.
- Do the sensor configuration (for more details see chapter 6.2.2) before starting the measurements.

NOTICE

Switching off the power supply before the configuration process (at power up) is finished properly may result in an unrecoverable problem condition.

- Avoid switching off the power supply just after switching it on.

6.5 Firmware download

The exchangeable cover with Industrial Ethernet provides the possibility of a firmware download. Nonetheless the Dimetix update policy comply with the following guidelines: It's not needed to generally update all Industrial Ethernet module. For normal operation a firmware update is often not necessary and the effort to do an update can be saved. For details or to check for needed updates please contact Dimetix.

7 PROFINET®

7.1 Specifications

	Properties / Possibilities
Cyclic time	≥1 ms (RT_CLASS_1)
Baud rate	100 Mbit/s Full-Duplex mode
Topology recognition	LLDP, SNMP V1, MIB2, physical device
Cyclic process data	Distance data, measurement control, sensor state (For details see chapter 7.3.1)
Acyclic communication	Read and Write Record Service (For details see chapter 7.3.2)
Media redundancy	Media Redundancy Protocol (MRP) – Client
Supported protocols	RTC Real Time Cyclic Protocol, RT_CLASS_1 (unsynchronized) RTA Real Time Acyclic Protocol DCP Discovery and Configuration Protocol DCE/RPC Distributed Computing Environment /Remote Procedure Calls: Connectionless RPC LLDP Link Layer Discovery Protocol PTCP Precision Transparent Clock Protocol SNMP Simple Network Management Protocol
Identification & Maintenance	Reading / Writing of I&M1-3, Reading of I&M5
Isochronous Real Time (IRT) support	Yes, 2 port IRT switch (no IRT application)
Additionally supported features	VLAN- and priority tagging
Multiple Application Relation (AR)	1 IO-AR, 1 Supervisor AR, 1 Supervisor-DA AR
PROFINET IO specification	V2.3, legacy startup of specification V2.2 is supported
Certification	PNIO version V2.33, net load class: CLASS III, conformance class (CC-B)

7.2 Status LED

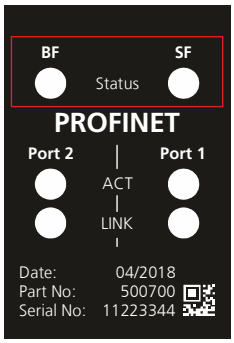


Figure 10: PROFINET® status LED's

The status LED's of the PROFINET® protocol are marked in figure 10. The possible PROFINET® status conditions are displayed with two red status LED's with three LED states – OFF, ON or FLASHING.

Status LED's:

- Bus Failure (BF) – Red LED
- System Failure (SF) – Red LED

The PROFINET® status conditions and some notes about troubleshooting are described in the table below.

LED	**Color**	**State**	**Meaning**	**Troubleshooting**
SF (System Failure)	○	Off	No error	
	☀	Flashing (1Hz)	DCP signal service is initiated via the bus.	
	☀	Flashing (2Hz)	System error: Invalid configuration, Watchdog error or internal error	
BF (Bus Failure)	○	Off	OK: No error detected.	
	☀	Flashing (2Hz)	Configuration fault: Device is not or not correctly configured.	Configure device or check configuration
	●	On	No connection: No Link.	Check wiring and connection

LINK	●	On	The device is linked to the Ethernet.	
	○	Off	The device has no link to the Ethernet	Check wiring and connection
ACT	☀	Flashing	The device sends/receives Ethernet frames	
	○	Off	The device does not send/receive Ethernet frames	

7.3 Parameter list

7.3.1 Cyclic process data

The cyclic process data (grouped in input / output data with fixed mapping and size) of the D-Series laser sensor with PROFINET® (exchangeable cover with Industrial Ethernet) are shown in the table below. Every single cyclic process data can be read with acyclic communication too (Remark: Read only, for more details see chapter 7.3.2).

Module Name IdentNumber	Submodule Name	Submodule IdentNumber	Slot	Subslot	Designation [1]	Data type	Access
Basic 0x00001000	Measurement Control	0x00001000	1	2	Measurement Control	UINT16	Output (Sensor input) 16 Byte
	Optional Output Data 0	0x00001001		3	Optional Output Data 0	UINT16	
	Optional Output Data 1	0x00001002		4	Optional Output Data 1	UINT32	
	Optional Output Data 2	0x00001003		5	Optional Output Data 2	UINT32	
	Optional Output Data 3	0x00001004		6	Optional Output Data 3	UINT32	
	Distance Integer	0x00002000		7	Distance Integer	UINT32	Input (Sensor output) 36 Byte
	Distance Float	0x00002001		8	Distance Float	FLOAT32	
	Signal Strength	0x00002002		9	Signal Strength	UINT32	
	Temperature	0x00002003		10	Temperature	SINT16	
	Distance Unit	0x00002004		11	Distance Unit	UINT8	
	Measurement Actuality	0x00002005		12	Measurement Actuality	UINT8	
	Measurement Reserved	0x00002006		13	Measurement Reserved	UINT16	
	Sensor State	0x00002007		14	Sensor State	UINT8	
	Sensor Output Data Limit Exceeded	0x00002008		15	Sensor Output Data Limit Exceeded	UINT8	
	Sensor Error Code	0x00002009		16	Sensor Error Code	UINT16	
	Optional Input Data 0	0x0000200A		17	Optional Input Data 0	UINT16	
	Optional Input Data 1	0x0000200B		18	Optional Input Data 1 / Speed Integer	UINT32	
	Optional Input Data 2	0x0000200C		19	Optional Input Data 2	UINT32	
	Optional Input Data 3	0x0000200D		20	Optional Input Data 3	UINT32	

[1] The process data designation corresponds directly to the parameter designation in the chapter 6.3 Parameter description. For details and descriptions of the parameter, see this general parameter description.

7.3.2 Acyclic communication

The acyclic communication used for data read / write access of the D-Series laser sensor with PROFINET® (exchangeable cover with Industrial Ethernet) are shown in the table below. The available access type of every data / parameter has to be considered. To access the data / parameter see the details about module, submodule, slot, subslot and index.

Module Name IdentNumber	Submodule Name IdentNumber	Slot	Subslot	Index	Parameter group	Designation [1]	Data type	Access type
Basic 0x00001000	Parameter Access Point 0x00000001	1	1	8193	Measurement Configuration	Measurement Control	UINT16	R
			1	8194		Measurement Speed	UINT32	R / W
			1	8195		Measurement Characteristic	UINT8	R / W
			1	8196		Distance Unit	UINT8	R / W

			1	8197		Additional Measurement Filter 1	UINT32	R / W
			1	8198		Additional Measurement Filter 2	UINT32	R / W
			1	8225	Options Output	Optional Output Data 0	UINT16	R
			1	8226		Optional Output Data 1	UINT32	R
			1	8227		Optional Output Data 2	UINT32	R
			1	8228		Optional Output Data 3	UINT32	R
			1	12289	Measurement	Distance Integer	UINT32	R
			1	12290		Distance Float	FLOAT32	R
			1	12291		Signal Strength	UINT32	R
			1	12292		Temperature	SINT16	R
			1	12293		Measurement Actuality	UINT8	R
			1	12294		Measurement Reserved	UINT16	R
			1	12321	Sensor State	Sensor State	UINT8	R
			1	12322		Sensor Output Data Limit Exceeded	UINT8	R
			1	12323		Sensor Error Code	UINT16	R
			1	12353	Options Input	Optional Input Data 0	UINT16	R
			1	12354		Optional Input Data 1	UINT32	R
			1	12355		Optional Input Data 2	UINT32	R
			1	12356		Optional Input Data 3	UINT32	R
Laser Distance Sensor DX400 0x00000001	Identification / Maintenance 0x00000010	0	1	16385	Hardware Information	Serial Number	UINT32	R
			1	16386		Part Number	UINT32	R
			1	16387		Part Description	STRING[20]	R
			1	16388		HW Version IF Board	UINT16	R
			1	16389		HW Version M Module	UINT16	R
			1	16390		Serial Number RTE	UINT32	R
			1	16391		Part Number RTE	UINT32	R
			1	16392		Part Description RTE	STRING[20]	R
			1	16393		HW Version RTE	UINT16	R
			1	16417	Firmware Information	FW Version IF Board	UINT16	R
			1	16418		FW Version M Module	UINT16	R
			1	16419		FW Version SSBL RTE	UINT32	R
			1	16420		FW Version Stack RTE	UINT32	R

[1)] The acyclic data designation corresponds directly to the parameter designation in the chapter 6.3 Parameter description. For details and descriptions of the parameter, see this general parameter description.

7.4 Configuration

7.4.1 Overview

Name of Station	Factory default: "laserdistancesensor"

7.4.2 Device description file (GSDML)

General the GSDML are GSD files written in XML format and contains information about the basic capabilities and features of a PROFINET device. It allows system integrators the determination of basic data such as the communications options and the available diagnostics. The aim is to enable simple integration of PROFINET® devices into an engineering tool. GSDML editing can be accomplished with standard XML editors and should comply with ISO 15745, the base for device descriptions.

The required GSDML file for the PROFINET® protocol of the exchangeable cover with Industrial Ethernet can be downloaded from the Dimetix website (www.dimetix.com/IndustrialEthernet).

7.4.3 Software / Tools

No additional software in needed. The configurations of the laser distance sensor can be done over the Industrial Ethernet interface.

The "Ethernet Device Configuration" software (free of charge) from Hilscher can be used to find or configure a PROFINET® device (e.g. MAC, Name of Station,...).

7.5 Connection

Currently no additional information.

8 EtherNet/IP™

8.1 Specifications

	Properties / Possibilities
IO Connection Types (implicit)	Exclusive Owner Listen Only Input only
IO Connection Trigger Types	Cyclic (min. 1 ms) Application triggered (min. 1 ms) Change of state (min. 1 ms)
Baud rate	10 / 100 Mbit/s
Duplex modes	Half duplex Full duplex Auto-Negotiation
MDI modes	MDI, MDI-X, Auto-MDIX
Data transport layer	Ethernet II, IEEE 802.3
Cyclic process data	Distance data, measurement control, sensor state (For details see chapter 8.3.1)
Acyclic communication	Set and Get Attribute (For details see chapter 8.3.2)
Predefined standard objects	Identity Object (0x01) Message Route Object (0x02) Assembly Object (0x04) Connection Manager (0x06) Ethernet Link Object (0xF6) TCP/IP Object (0xF5) DLR Object (0x47) QoS Object (0x48)
Features supported	DLR (Device Level Ring), beacon based "Ring Node" ACD (Address Conflict Detection) DHCP, BOOTP Integrated switch
Supported topology	Tree, Line or Ring

8.2 Status LED

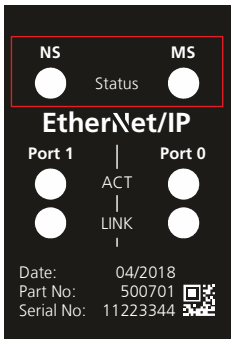


Figure 11: EtherNet/IP™ status LED's

The status LED's of the EtherNet/IP™ protocol are marked in figure 11. The possible EtherNet/IP™ status conditions are displayed with two green and two red status LED's with three LED states – OFF, ON or FLASHING.

Status LED's:

- Network Status (NS) – Green / Red LED
- Module Status (MS) – Green / Red LED

The EtherNet/IP™ status conditions and some notes about troubleshooting are described in the table below.

LED	Color	State	Meaning	Troubleshooting
MS (Module Status)	●	On	Device operational: The device is operating correctly.	
	☀	Flashing (1Hz)	Standby: The device has not been configured.	
	☀ ☀	Flashing (1Hz)	Selftest: The device is performing its power up testing.	

		Flashing (1Hz)	Minor fault: The device has detected a recoverable minor fault. E.g. an incorrect or inconsistent configuration can be considered as a minor fault.	Configure device or check configuration
		On	Major fault: The device has detected a nonrecoverable major fault.	
		Off	No power: The power supply to the device is missing.	Check wiring and connection
NS (Network Status)		On	Connected: The device has at least one established connection (even to the Message Router).	
		Flashing (1Hz)	No connections: The device has no established connections, but has obtained an IP address.	
		Flashing (1Hz)	Selftest: The device is performing its power up testing.	
		Flashing (1Hz)	Connection timeout: The device connections has timed out. This status will be finished only if timed out connections is reestablished or if the device is reset.	
		On	Duplicate IP: The device has detected that its IP address is already in use.	Configure device or check configuration
		Off	Not powered, no IP address: The device does not have an IP address (or is powered off).	Check wiring and connection
LINK		On	The device is linked to the Ethernet.	
		Off	The device has no link to the Ethernet	Check wiring and connection
ACT		Flashing	The device sends/receives Ethernet frames	
		Off	The device does not send/receive Ethernet frames	

8.3 Parameter list

8.3.1 Cyclic process data

The cyclic process data (grouped in input / output data with fixed mapping and size) of the D-Series laser sensor with EtherNet/IP™ (exchangeable cover with Industrial Ethernet) are shown in the table below. Every single cyclic process data can be read with acyclic communication too (Remark: Read only, for more details see chapter 8.3.2).

Assembly Name	Assembly	Class	Instance	Attribute	Designation [1)]	Data type	Access
Output Basic	0x64	0x64	1	1	Measurement Control	UINT16	Output (Sensor input) 16 Byte
		0x69	1	1	Optional Output Data 0	UINT16	
				2	Optional Output Data 1	UINT32	
				3	Optional Output Data 2	UINT32	
				4	Optional Output Data 3	UINT32	
Input Basic	0x96	0x82	1	1	Distance Integer	UINT32	Input (Sensor output) 36 Byte
				2	Distance Float	FLOAT32	
				3	Signal Strength	UINT32	
				4	Temperature	SINT16	
		0x64	1	4	Distance Unit	UINT8	
		0x82	1	5	Measurement Actuality	UINT8	
				6	Measurement Reserved	UINT16	
		0x87	1	1	Sensor State	UINT8	
				2	Sensor Output Data Limit Exceeded	UINT8	
				3	Sensor Error Code	UINT16	

		0x8C	1	1	Optional Input Data 0	UINT16	
				2	Optional Input Data 1 / Speed Integer	UINT32	
				3	Optional Input Data 2	UINT32	
				4	Optional Input Data 3	UINT32	

[1)] The process data designation corresponds directly to the parameter designation in the chapter 6.3 Parameter description. For details and descriptions of the parameter, see this general parameter description.

8.3.2 Acyclic communication

The acyclic communication used for data read / write access of the D-Series laser sensor with EtherNet/IP™ (exchangeable cover with Industrial Ethernet) are shown in the table below. The available access type of every data / parameter has to be considered. To access the data / parameter see the details about class, instance and attribute.

Class	Instance	Attribute	Parameter group	Designation [1)]	Data type	Access type
0x64	1	1	Measurement Configuration	Measurement Control	UINT16	R
		2		Measurement Speed	UINT32	R / W
		3		Measurement Characteristic	UINT8	R / W
		4		Distance Unit	UINT8	R / W
		5		Additional Measurement Filter 1	UINT32	R / W
		6		Additional Measurement Filter 2	UINT32	R / W
0x69	1	1	Options Output	Optional Output Data 0	UINT16	R
		2		Optional Output Data 1	UINT32	R
		3		Optional Output Data 2	UINT32	R
		4		Optional Output Data 3	UINT32	R
0x82	1	1	Measurement	Distance Integer	UINT32	R
		2		Distance Float	FLOAT32	R
		3		Signal Strength	UINT32	R
		4		Temperature	SINT16	R
		5		Measurement Actuality	UINT8	R
		6		Measurement Reserved	UINT16	R
0x87	1	1	Sensor State	Sensor State	UINT8	R
		2		Sensor Output Data Limit Exceeded	UINT8	R
		3		Sensor Error Code	UINT16	R
0x8C	1	1	Options Input	Optional Input Data 0	UINT16	R
		2		Optional Input Data 1	UINT32	R
		3		Optional Input Data 2	UINT32	R
		4		Optional Input Data 3	UINT32	R
0xA0	1	1	Hardware Information	Serial Number	UINT32	R
		2		Part Number	UINT32	R
		3		Part Description	STRING[20]	R
		4		HW Version IF Board	UINT16	R
		5		HW Version M Module	UINT16	R
		6		Serial Number RTE	UINT32	R
		7		Part Number RTE	UINT32	R
		8		Part Description RTE	STRING[20]	R
		9		HW Version RTE	UINT16	R
0xA5	1	1	Firmware	FW Version IF Board	UINT16	R

		2	Information	FW Version M Module	UINT16	R
		3		FW Version SSBL RTE	UINT32	R
		4		FW Version Stack RTE	UINT32	R

[1] The acyclic data designation corresponds directly to the parameter designation in the chapter 6.3 Parameter description. For details and descriptions of the parameter, see this general parameter description.

8.4 Configuration

8.4.1 Overview

Configuration control	Static / BOOTP / DHCP (Factory default: Static)
IP address	e.g. 192.168.0.20 (Factory default: 192.168.0.20
RUN / IDLE notification	RUN –› Cyclic process data exchange running IDLE –› Save values, no cyclic process data exchange

8.4.2 Electronic Data Sheet (EDS)

General the EDS (Electronic Data Sheet) files is an ASCII text file that describes the features of EtherNet/IP™ device and is used by software tools for device and network configuration.

The required EDS file for the EtherNet/IP™ protocol of the exchangeable cover with Industrial Ethernet can be downloaded from the Dimetix website (www.dimetix.com/IndustrialEthernet).

8.4.3 Software / Tools

No additional software in needed. The configurations of the laser distance sensor can be done over the Industrial Ethernet interface.

The “Ethernet Device Configuration” software (free of charge) from Hilscher can be used to find an EtherNet/IP™ device (e.g. MAC, IP,...). The software “BOOTP/DHCP Server” from Rockwell Automation can be used too to search and configure device settings. e.g. IP or configuration control (Static, DHCP, BOOTP).

8.5 Connection

Remark: RPI interval time configuration for cyclic IO data communication (min. 1 ms, see specifications).

9 EtherCAT®

9.1 Specifications

	Properties / Possibilities
Cyclic time	≥2 ms in Free Run Mode
Baud rate	100 Mbit/s
Cyclic process data	TxPDO with fixed mapping (For details see chapter 9.3.1)
Acyclic communication	SDO Master-Slave (For details see chapter 9.3.2)
Supported protocols	SDO client and server side protocol (CoE) File Access over EtherCAT® (FoE)
CoE (CAN application layer over EtherCAT®)	SDO Upload and SDO Download including SDO Complete Access SDO Information Service (Object Dictionary)
Mailbox size	Fix length of 128 Byte
SII (Slave Information Interface)	4 kByte
Type	Complex Slave
SYNC Manager	4
FMMU's (Fieldbus Memory Management Unit)	8
Explicit Device Identification	Set device identification by configuration tool???
EtherCAT® Conformance	EtherCAT® Protocol: - EtherCAT® Conformance Test Tool V2.1.0.2 - EtherCAT® Conformance Test Record ETG7000-2 V1.2.8 ETG.1300 Indicator Specification ETG.9001 Marking rules Interoperability Test
Supported topology	Line or Ring

9.2 Status LED

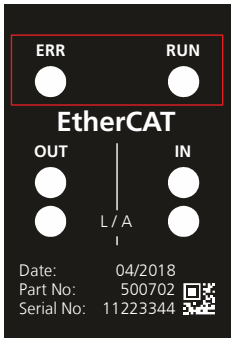


Figure 12: EtherCAT® status LED's

The status LED's of the EtherCAT® protocol are marked in figure 12. The possible EtherCAT® status conditions are displayed with a green and a red status LED's with three LED states – OFF, ON or FLASHING.

Status LED's:

- Error status (ERR) – Red LED
- Run status (RUN) – Green LED

The EtherCAT® status conditions and some notes about troubleshooting are described in the table below.

LED	Color	State	Meaning	Troubleshooting
RUN	○	Off	INIT: The device is in INIT state.	
	☼	Flashing (2.5Hz)	PRE-OPERATIONAL: The device is in PREOPERATIONAL state.	
	☼	Flashing (10Hz)	BOOT: Device is in Boot mode.	
	☼	Single flash	SAFE-OPERATIONAL: The device is in SAFE-OPERATIONAL state.	
	●	On	OPERATIONAL: The device is in the OPERATIONAL state.	

ERR	○	Off	Slave has no errors	
	●	On	Slave has detected a communication error. The error is indicated in the DPM.	Check wiring and connection
LINK	●	On	The device is linked to the Ethernet.	
	○	Off	The device has no link to the Ethernet	Check wiring and connection
ACT	☀	Flashing	The device sends/receives Ethernet frames	
	○	Off	The device does not send/receive Ethernet frames	

9.3 Parameter list

9.3.1 Cyclic process data

The cyclic process data (grouped in input / output data with fixed mapping and size) of the D-Series laser sensor with EtherCAT® (exchangeable cover with Industrial Ethernet) are shown in the table below. Every single cyclic process data can be read with acyclic communication too (Remark: Read only, for more details see chapter 9.3.2).

PDO Name	PDO Index	PDO Subindex	Index	Subindex	Designation [1]	Data type	Access
Output Basic	0x1600	0x01	0x2000	0x01	Measurement Control	UINT16	Output (Sensor input) 16 Byte
		0x02	0x2020	0x01	Optional Output Data 0	UINT16	
		0x03		0x02	Optional Output Data 1	UINT32	
		0x04		0x03	Optional Output Data 2	UINT32	
		0x05		0x04	Optional Output Data 3	UINT32	
Input Basic	0x1A00	0x01	0x3000	0x01	Distance Integer	UINT32	Input (Sensor output) 36 Byte
		0x02		0x02	Distance Float	FLOAT32	
		0x03		0x03	Signal Strength	UINT32	
		0x04		0x04	Temperature	SINT16	
		0x05	0x2000	0x04	Distance Unit	UINT8	
		0x06	0x3000	0x05	Measurement Actuality	UINT8	
		0x07		0x06	Measurement Reserved	UINT16	
		0x08	0x3020	0x01	Sensor State	UINT8	
		0x09		0x02	Sensor Output Data Limit Exceeded	UINT8	
		0x0A		0x03	Sensor Error Code	UINT16	
		0x0B	0x3040	0x01	Optional Input Data 0	UINT16	
		0x0C		0x02	Optional Input Data 1 / Speed Integer	UINT32	
		0x0D		0x03	Optional Input Data 2	UINT32	
		0x0E		0x04	Optional Input Data 3	UINT32	

[1] The process data designation corresponds directly to the parameter designation in the chapter 6.3 Parameter description. For details and descriptions of the parameter, see this general parameter description.

9.3.2 Acyclic communication

The acyclic communication used for data read / write access of the D-Series laser sensor with EtherCAT® (exchangeable cover with Industrial Ethernet) are shown in the table below. The available access type of every data / parameter has to be considered. To access the data / parameter see the details about the index and subindex.

Index	Subindex	Parameter group	Designation [1]	Data type	Access type
0x2000	0x01	Measurement	Measurement Control	UINT16	R

	0x02	Configuration	Measurement Speed	UINT32	R / W
	0x03		Measurement Characteristic	UINT8	R / W
	0x04		Distance Unit	UINT8	R / W
	0x05		Additional Measurement Filter 1	UINT32	R / W
	0x06		Additional Measurement Filter 2	UINT32	R / W
0x2020	0x01	Options Output	Optional Output Data 0	UINT16	R
	0x02		Optional Output Data 1	UINT32	R
	0x03		Optional Output Data 2	UINT32	R
	0x04		Optional Output Data 3	UINT32	R
0x3000	0x01	Measurement	Distance Integer	UINT32	R
	0x02		Distance Float	FLOAT32	R
	0x03		Signal Strength	UINT32	R
	0x04		Temperature	SINT16	R
	0x05		Measurement Actuality	UINT8	R
	0x06		Measurement Reserved	UINT16	R
0x3020	0x01	Sensor State	Sensor State	UINT8	R
	0x02		Sensor Output Data Limit Exceeded	UINT8	R
	0x03		Sensor Error Code	UINT16	R
0x3040	0x01	Options Input	Optional Input Data 0	UINT16	R
	0x02		Optional Input Data 1	UINT32	R
	0x03		Optional Input Data 2	UINT32	R
	0x04		Optional Input Data 3	UINT32	R
0x4000	0x01	Hardware Information	Serial Number	UINT32	R
	0x02		Part Number	UINT32	R
	0x03		Part Description	STRING[20]	R
	0x04		HW Version IF Board	UINT16	R
	0x05		HW Version M Module	UINT16	R
	0x06		Serial Number RTE	UINT32	R
	0x07		Part Number RTE	UINT32	R
	0x08		Part Description RTE	STRING[20]	R
	0x09		HW Version RTE	UINT16	R
0x4020	0x01	Firmware Information	FW Version IF Board	UINT16	R
	0x02		FW Version M Module	UINT16	R
	0x03		FW Version SSBL RTE	UINT32	R
	0x04		FW Version Stack RTE	UINT32	R

[1] The acyclic data designation corresponds directly to the parameter designation in the chapter 6.3 Parameter description. For details and descriptions of the parameter, see this general parameter description.

9.4 Configuration

9.4.1 Overview

Configured Station Alias	Device Reset sets this back to 0

9.4.2 EtherCAT Slave Information (ESI)

General the ESI (EtherCAT® Slave Information) files is written in XML format and contains the complete description of its network accessible properties, such as process data and their mapping options, the supported mailbox protocols including optional features, as well as the supported modes of synchronization. The Network Configuration Tool uses this information for online and offline configuration of the network.

The required ESI file for the EtherCAT® protocol of the exchangeable cover with Industrial Ethernet can be downloaded from the Dimetix website (www.dimetix.com/IndustrialEthernet).

9.4.3 Software / Tools

No additional software in needed. The configurations of the laser distance sensor can be done over the Industrial Ethernet interface.

The "Ethernet Device Configuration" software (free of charge) from Hilscher can be used to find an EtherCAT® device (e.g. MAC,...).

9.5 Connection

Currently no additional information.

10 Frequently asked questions (FAQ's)

Topics	Questions	Answers
AOI	Is there an AOI file available for EtherNet/IP?	No, because of the simple data structure and few available process data, the AOI is unnecessary.
Tools	Is there a general tool to find / check the device configuration (NameOfStation, IP, MAC, etc.)?	The "Ethernet Device Configuration" software (free of charge) from Hilscher can be used to find or configure a PROFINET®, EtherNet/IP™ or EtherCAT® device. To search for connected devices do the following steps: 1. Connect the laser sensor to a PC (direct or with switch) 2. Search for device with "Ethernet Device Configuration" tool 3. Check the listed device: I NameOfStation, IP, MAC, etc. 4. Check for available configurations (depends on Industrial Ethernet)
	Is there a general tool for doing some basic configurations or to check them (NameOfStation, IP, MAC, etc.)?	
	Is there a tool to manage DHCP / BOOTP settings of the EtherNet/IP device?	For example the "BOOTP/DHCP Server" software from Rockwell Automation can be used to find a lost EtherNet/IP™ device with DHCP / BOOTP configuration. The BOOTP / DHCP server lists connected devices and allows to assign a IP address according the MAC addresses.
	Is there a tool to run the Industrial Ethernet interface without a PLC?	The "PROFINET Master Simulator" of Anybus® by HMS is a easy cost-effective software tool to run PROFINET without the need of a PLC. Cyclic process data as well as acyclic parameters can be exchanged directly between the laser sensor and a computer (over Ethernet cable between laser sensor and computer).

11 Glossary

AOI	Add-On Instructions (used for EtherNet/IP) are a kind of predefined function blocks to assist customers by doing calculations with the EtherNet/IP™ adapter data in "Studio 5000®" software (Rockwell Automation).
AOP	Add On Profile used with EtherNet/IP
ESD	Electrostatic Discharge
EMC	Electromagnetic Compatibility
FLOAT	Single-precision floating point. Floating point with size: FLOAT32 –› 32 Bit
GSD / GSDML	Device description file (GSD) written in XML format (used with PROFINET®)
Industrial Ethernet	Industrial Ethernet interfaces e.g. PROFINET®, EtherCAT®, EtherNet/IP™ (Real-Time Ethernet interfaces)
IRT	Isochronous Real Time. Used for PROFINET IO applications in drive systems with cyclic times of less than 1 ms
PLC	Programmable Logic Controller (e.g. Siemens S7)
R	Read access only (Read-only)
R / W	Read & Write access possible
RPI	Requested Packet Interval. Interval time for cyclic data communication (used for process data).
SINT	Signed integer. Integer value with size: SINT8 –› 8 Bit (-128...127), SINT16 –› 16 Bit (-32'768...32'767), SINT32 –› 32 Bit (-2'147'483'648...2'147'483'647)
SSBL	Second Stage Bootloader
STRING	Character string of variable length. Character size of one Byte.
UINT	Unsigned integer. Integer value with size: UINT8 –› 8 Bit (0...255), UINT16 –› 16 Bit (0...65'535), UINT32 –› 32 Bit (0...4'294'967'295)

12 Revision history

The release versions and the changes of this technical reference manual are listed below.

Date	Revision	Changes
23.04.2018	V0.09	First release of the Technical Reference Manual of the Industrial Ethernet.
25.05.2018	V0.10	Added some operation descriptions and additional information about the access type in the parameter list.
23.10.2019	V0.11	Corrected factory default of Name of Station to “laserdistancesensor” in chapter 7.4.1 (used for PROFINET® interface).
30.04.2020	V0.12	Added table of port assignment in chapter 5.2 Ethernet ports used for the available Industrial Ethernet protocols. New chapter 1 Document scope and chapter 2.1 Explanation of symbols at the beginning of the document. Moved chapter Safety instructions to the beginning of the document. Introduced the signal words CAUTION, WARNING, NOTICE and revised the warning messages. Revised chapter 6.4 Startup / Shutdown procedure.
18.12.2020	V0.13	Added relative humidity (operation / storage) in the specification table. Changed Measurement Speed parameter upper limit to 86'400'000 [ms]. Added required interface board firmware version to chapter 3.3 Validity. New parameter number 8197 and 8198 for additional measurement filter 1 & 2 configuration in the table in 6.3 Parameter description. New note for parameter Distance Integer (distance will be truncated) in the table in 6.3 Parameter description. New sensor speed measurement data in optional input data 1 in the table in 6.3 Parameter description. Added new parameter in PROFINET® parameter list in chapter 7.3. Added new parameter in EtherNet/IP™ parameter list in chapter 8.3. Added new parameter in EtherCAT® parameter list in chapter 9.3.

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